Forecast for the 2017

Gulf and Atlantic Menhaden Purse-Seine Fisheries

and

Review of the 2016 Fishing Season

March 2017

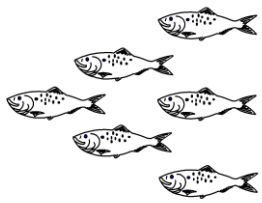
Sustainable Fisheries Branch, NMFS Beaufort, NC

INTRODUCTION

The 2017 fishing year marks the forty-fifth year that the National Marine Fisheries Service has made quantitative forecasts of purse-seine landings of menhaden. The forecasts are based on a multiple regression equation that relates landings and fishing effort over a series of years. Landings forecasts are conditioned on estimates of expected fishing effort for the upcoming fishing year. Fishing effort estimates are vessel-specific and are derived from 1) industry input regarding the number of vessels that companies expect to be active during the upcoming fishing year, and 2) historical performance (catch and effort) of the vessels expected to participate in the fishery. In the Atlantic Menhaden fishery, actual purse-seine landings have differed an average of 13% from those forecasted for the forty year period, 1973-2012 (pre-TAC years; see page 4). Landings in the Gulf Menhaden fishery have differed from those forecasted by an average of 14% for the forty-four year period, 1973-2016. In this forecast report, we review the 2016 Gulf and Atlantic Menhaden fishing seasons in terms of:

- landings and fleet size
- age composition of the catch
- status of the most recent forecast

Finally, we will forecast estimated landings for the 2017 menhaden fishing season.



GULF MENHADEN FISHERY

Gulf Menhaden Landings, Fishing Conditions, and Vessel Participation in 2016

Final purse-seine landings of Gulf Menhaden for reduction in 2016 totaled 485,857 metric tons (mt; 1,599 million standard fish). This is a decrease of 9.3% from total landings in 2015 (535,688 mt), and 7.2% less than the previous 5-year mean (523,333 mt; Figure 1).

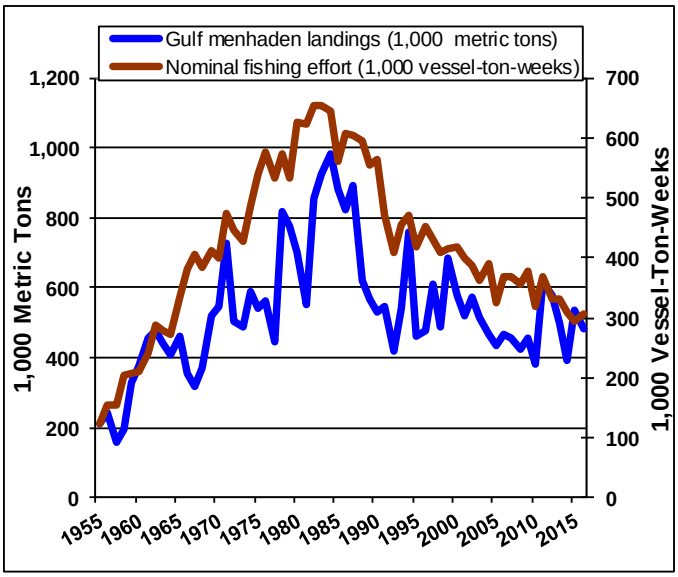


Figure 1. Gulf Menhaden landings in 1,000s of metric tons (mt) and nominal fishing effort in 1,000s of vessel-ton-weeks (VTW), 1955–2016.

Prior to the fishing season, winter 2015-2016 across much of the Mississippi Basin was warmer than average with above-average precipitation. Above-average snowpack ensured a good supply of water for the Mississippi River and its tributaries. The Gulf Coast shared in the warmer-than-average temperatures and precipitation. Beginning in March,

the Mississippi River Basin began to experience warmer-than usual temperatures with much greater-than-average precipitation that would continue until the fishing season began.

The 2016 Gulf Menhaden fishing season opened on April 18th. Landings in April (25,981 mt) were higher than 2015 and slightly above the previous 5-year average (Fig 2). Landings in May (75,464 mt) were also higher than 2015 landings, but were lower than the 5-year average.

Tropical Storm Colin moved through the eastern portion of the Gulf of Mexico on June 6. Landings continued to increase into June (102,866 mt), higher than landings in 2015 and the highest landings for that month since 2011.

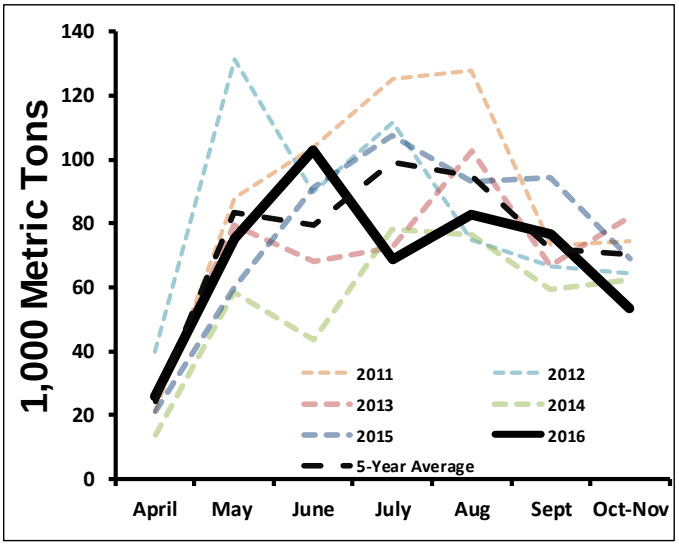


Figure 2. Gulf Menhaden landings by month, 2013-2016.

After the July 4th holiday, although fishing was steady and active through the rest of the month, landings decreased to below the 5-year average (68,685 mt). July landings were the lowest for that month since 2010.

Landings increased after dropping in July, but remained below the five-year average for the month of August (82,606 mt). In mid-August, a nearly stationary low-pressure system dumped torrential rainfall across the state of Louisiana, contributing to the monthly record precipitation for that state of almost 13 inches. Later in the month, Hurricane Hermine followed a similar path to that of TS Colin. Both of these events are likely to have impacted fishing for the month of August. After Hurricane Hermine departed, conditions were favorable for much of the rest of the month and September concluded above the 5-year average (76,812 mt).

October weather was hot across much of the southeast, but aside from the heat it was rather unremarkable with regards to fishing. Most of the relatively few extreme weather events in the region were due to Hurricane Matthew. Fishing was concluded for the season with the final landings occurring on November 1 and combined October-November landings were 53,443 mt.

In 2016, 34 vessels unloaded Gulf Menhaden for reduction: 31 regular steamers, two run boats, and one bait vessel.

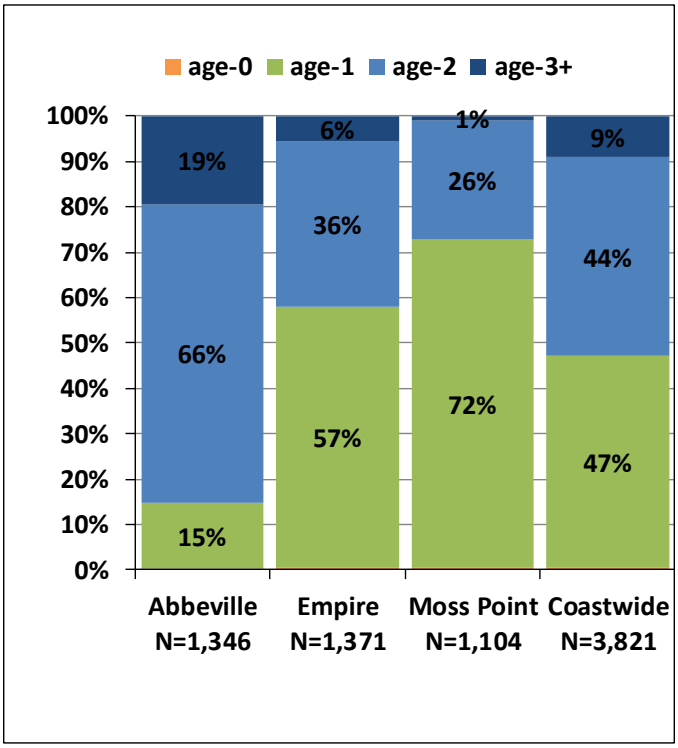


Figure 3. Percent estimated numbers-at-age of Gulf menhaden by port in 2016.

Age Composition of Gulf Menhaden in 2016

Approximately 3,821 Gulf Menhaden have been aged from the 2016 port samples to date (Fig. 3). From the preliminary catch-at-age matrix, coastwide age-1 fish (47%) only slightly outnumbered age-2 fish (44%), and both ages exceeded all older ages combined (9%, Table 1). An east-west gradient in the proportion of ages existed where a higher percentage of age-1 fish were landed at Moss Point (72%), than at Empire (57%) and Abbeville (15%, Figure 3). Most fish landed at Abbeville (66%), were age-2, but smaller percentages of age-2 fish were

found at Empire (36%) and Moss Point (26%). Age-3 and older fish were also more abundant in Abbeville (19%) than at Empire (6%) and Moss Point (1%).

Table 1. Percent age composition, estimated total numbers of fish caught, and total landings for the Gulf Menhaden fishery, 2012-2016; 2016 data are preliminary.

Year	Age-0	Age-1	Age-2	Estimated total number of fish caught in billions	Landings in thousands of metric tons
2016	<1%	47%	44%	4.95	484.8
2015	-	56%	35%	6.20	535.7
2014	1%	26%	60%	3.51	391.9
2013	<1%	25%	73%	4.54	497.5
2012	<1%	31%	66%	6.78	578.4

Fishing Effort in 2016 and Review of the 2017 Forecast for Gulf Menhaden

Nominal fishing effort for the Gulf Menhaden fishery during 2016 was estimated at 307,700 vessel-ton-weeks; this is 4.6% more than nominal fishing effort in 2015 (294,200 vessel-ton-weeks).

In March 2016, we anticipated that nominal fishing effort during 2016 could amount to 320,000 vessel-ton-weeks with 33 vessels participating in the fishery. With this level of anticipated fishing effort, we forecasted 2016 Gulf Menhaden landings of 467,000 mt with 80% confidence levels of 282,000 and 519,000 mt. A "hindcast" using our forecast model and actual nominal fishing effort in 2016 produced a post-season forecast of 470,100 mt with 80% confidence levels of 348,000 and 592,000 mt. Actual landings of 484,750 mt were 3.1% more than our post-season estimate.

Forecast for the 2017 Gulf Menhaden Fishing Season

As in 2016, we expect that three menhaden factories (Moss Point, MS, and Empire and Abbeville, LA) will process Gulf Menhaden in 2017. Our best estimate of vessel participation is for 33 vessels: 31 regular steamers, one run boat, and one bait boat. Based on average nominal fishing effort for recent years by the vessels expected to be active in 2017, we estimate that nominal fishing effort in 2017 may be about 301,000 vessel-ton-weeks; with this level of nominal fishing effort, we forecast 2017 Gulf Menhaden landings of 436,000 mt, with 80% confidence levels of 424,000 and 447,000 mt.

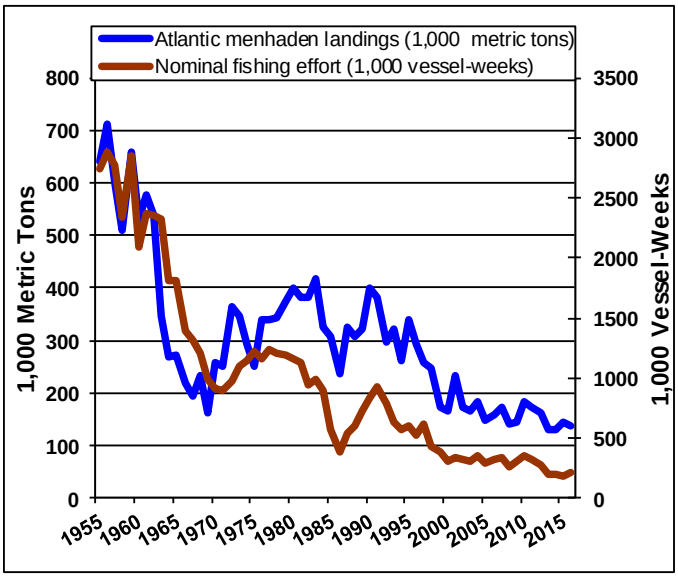


Figure 4. Atlantic Menhaden landings in 1,000s of metric tons and nominal fishing effort in 1,000s of vessel-weeks , 1955–2016.

ATLANTIC MENHADEN FISHERY

Atlantic Menhaden Landings, Fishing Conditions, and Vessel Participation in 2016

Atlantic Menhaden landings for reduction in 2016 amounted to 137,393 mt (452 million standard fish; Fig. 4). This is 14% less than purse-seine landings for the 2012 season (160,627 mt), the last season before implementation of the coastwide total allowable catch (TAC). It is also 14% less than average landings for the years 2008-12 (160,524 mt). As has been the case since 2005, only one menhaden factory, the Omega Protein plant at Reedville, VA, operated on the Atlantic coast in 2016.

In December 2012, the Atlantic States Marine Fisheries Commission (ASMFC) approved Amendment 2 to the Fishery Management Plan for Atlantic Menhaden which established a TAC for the reduction and bait fisheries combined of 170,800 mt beginning in 2013, and in 2015, this TAC was raised to 187,880 mt.

In Spring of 2016, large schools of Atlantic Menhaden were evident along the New England coast. The relatively high landings from their presence meant that the landings were not reallocated to the reduction fishery in the Fall as in recent years.

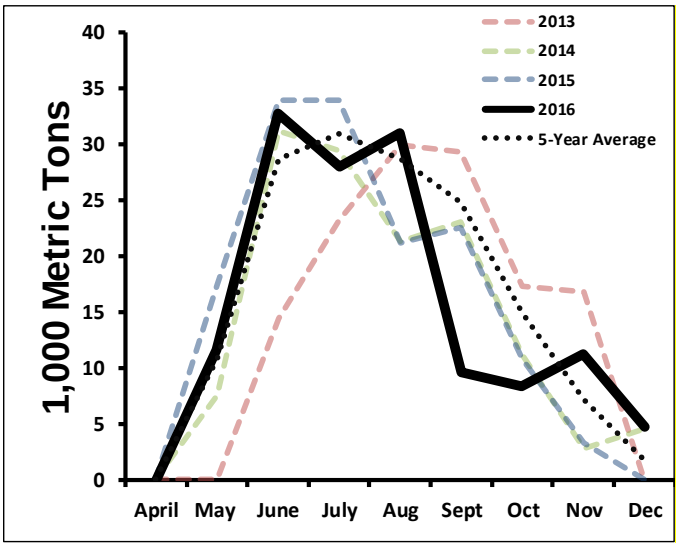


Figure 5. Atlantic Menhaden landings by month, 2013–2016.

The beginning of the reduction fishery in May saw relatively calm weather, with the number of extreme weather reports below average. Omega Protein vessels began fishing on May 16th and fishing for the first month of the season was above the five-year average. Atlantic Menhaden landings for reduction during May 2016 were slightly above the five-year average at 11,657 mt (Fig. 5).

This year was the first year to experience above-average hurricane activity since 2012, with fifteen named storms and four major hurricanes. The first of these tropical cyclones to make landfall on the continental United States did so in May. Tropical Storm Bonnie made landfall in South Carolina, causing minor damage and finally dissipating just in time for the remnants of Tropical Storm Colin to make an arrival from the Gulf of Mexico.

Landings continued to be above average in June at 32,749 mt, the month for peak landings in 2016. After a decrease in July to 28,058 mt, landings increased to 30,984 mt in August.

In September, there were many more severe weather reports in the Southeast region than average. In addition to the general extreme weather, Hurricane Hermine and Tropical Storm Julia disrupted fishing activity on separate occasions. As a result, landings declined sharply in September (9,597 mt), the lowest landings for that month in decades.

In early October, Hurricane Matthew struck the east coast of the United States, causing many states to call for evacuations and causing widespread damage. Hurricane Matthew disrupted fishing for a portion of the month, resulting in low landings (8,414 mt), the lowest since 2009. Fishing continued through November and December, reported landings were relatively high for those months (11,247 mt and 4,687 mt, respectively). Atlantic Menhaden remained abundant in the mid-Atlantic, and were not observed to migrate south in December as they usually do. All reduction fleet vessels were cut out by December 16.

The coastwide TAC for Atlantic Menhaden also included the bait fisheries. Bait allocations by state were assigned based on landings histories during 2009-11. The snapper rig purse-seine fishery for bait in Virginia started the week of May 9th. Bait landings continued through October.

Purse-seine landings of menhaden in New Jersey began in mid-May. New Jersey's purse-seine TAC was reached in early June and the fishery closed, before re-opening for a week in mid-July. The TAC for gears other than purse seine were open until March 3, when those fisheries closed.

The Atlantic States Marine Fisheries Commission approved an episodic event fishery for Atlantic menhaden for 2016. New York, Rhode Island, Massachusetts, and Maine participated in the fishery and harvested all that was allocated before closing their directed fisheries by the beginning of September.

Age Composition of Atlantic Menhaden in 2016

Approximately 2,500 Atlantic Menhaden were sampled for size and age from the 2016 reduction fishery. Coastwide age-2 fish (49%) were slightly less than the combined age-1 fish (26%) and age-3 fish (24%, Fig. 6 and Table 2). Age-4 fish made slightly more than 1%; age-0s, or "peanuts", accounted approximately 2% of the catch for 2016.

Catches for reduction off New Jersey and the Delmarva Peninsula during 2016 consisted mostly of

age-3+ fish (51%), followed by age-2 fish (41%) and few age-1 fish (8%). Most of the catch from Chesapeake Bay and ocean areas near the mouth of the Bay during summer were age-2 (53%), followed by age-1 (30%) and age-3 fish (17%). During the fall fishery, most fish were aged zero (53%), followed by age-1 (34%), age-2 (9%), and 5% of fish sampled were age-3.

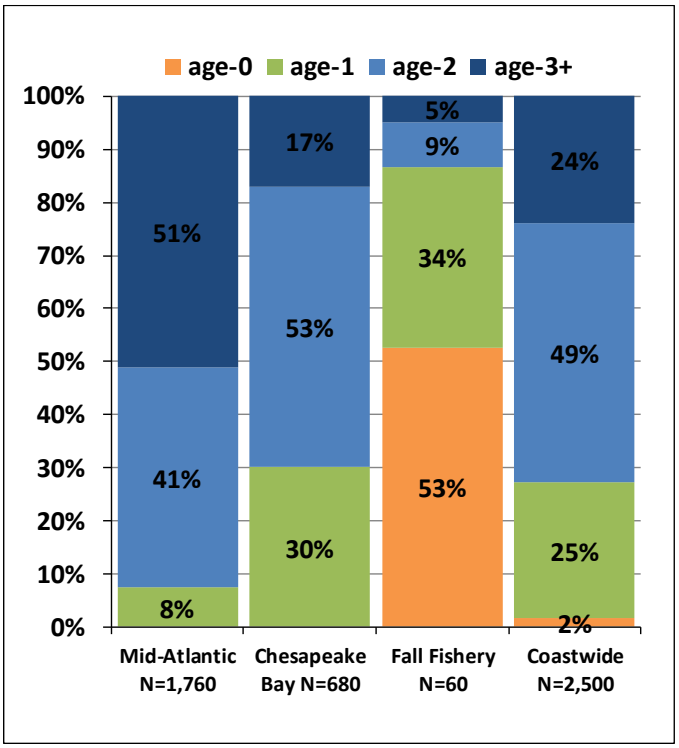


Figure 6. Percent estimated numbers at age of Atlantic Menhaden by area in 2016.

About 420 samples of Atlantic Menhaden have been aged from the bait fisheries on the East coast at this time. Bait samples from snapper-rig vessels in Chesapeake Bay consisted mostly of age-3 fish (43%) and age-2 fish (39%), followed by age-1 fish (15%) and a few age-4 (3%) and age-5 fish (<1%). Preliminary bait samples from off the New Jersey coast were mostly age-2 (51%) and age-3 (42%), followed by age-1 fish (2%) and a few age-4 and age-5 fish (1.9% each).

Fishing Effort in 2016

Nominal fishing effort in 2016 was estimated at 213 vessel-weeks, decreasing from 182 vessel-weeks expended in 2015. The decline in observed effort since 2012 is due to the TAC and the resultant decrease in number of steamers at the Reedville factory.

Table 2. Percent age composition of the reduction catch in the Atlantic Menhaden fishery, 2012–2016.

Year	Age-0	Age-1	Age-2	Age-3+
2016	0%	26%	50%	24%
2015	0%	14%	70%	16%
2014	1%	40%	41%	18%
2013	3%	38%	45%	14%
2012	1%	16%	79%	4%

Forecast for the 2017 Atlantic Menhaden Fishing Season

Amendment 2 to the Fishery Management Plan for Atlantic Menhaden specifies an annual coastwide TAC of about 129,900 mt for the purse-seine reduction fishery after removal of the episodic set-aside. This TAC remained until the 2014 Benchmark Assessment found that "the Atlantic Menhaden stock status is not overfished and overfishing is not occurring". In the years since, the reduction fishery TAC was raised in 2015 to 142,894 mt; in October, 2016, the Atlantic Menhaden Management Board met and approved an increase to the TAC for the 2017 fishing season. This increase results in 152,112 mt allocated to the reduction fishery. Resultant landings are expected to be close to this value.

Combined 2016 Gulf and Atlantic Menhaden Landings

Combined landings by the Gulf and Atlantic Menhaden purse-seine fisheries for reduction during 2016 year amounted to 1.37 billion pounds, a slight decrease from landings during the 2015 calendar year (1.5 billion pounds).

Fishing effort and landings in the Gulf Menhaden purse-seine fishery,1955-2016					
Year	**Fishing effort 1,000 vessel-ton-weeks**	**Landings 1,000 metric tons**	**Year**	**Fishing effort 1000 vessel-ton-weeks**	**Landings 1,000 metric tons**
1955	122.9	213.3	***1986***	606.5	822.1
1956	155.1	244.0	***1987***	604.2	894.2
1957	155.2	159.3	***1988***	594.1	623.7
1958	202.8	196.2	***1989***	555.3	569.6
1959	205.8	325.9	***1990***	563.1	528.3
1960	211.7	376.8	***1991***	472.3	544.3
1961	241.6	455.9	***1992***	408.0	421.4
1962	289.0	479.0	***1993***	455.2	539.2
1963	277.3	437.5	***1994***	472.0	761.6
1964	272.9	407.8	***1995***	417.0	463.9
1965	335.6	461.2	***1996***	451.7	479.4
1966	381.3	357.6	***1997***	430.2	611.2
1967	404.7	316.1	***1998***	409.3	486.2
1968	382.8	371.9	***1999***	414.5	684.3
1969	411.0	521.5	***2000***	417.6	579.3
1970	400.0	545.9	***2001***	400.6	521.3
1971	472.9	728.5	***2002***	386.7	574.5
1972	447.5	501.9	***2003***	363.2	517.1
1973	426.2	486.4	***2004***	390.5	468.7
1974	485.5	587.4	***2005***	326.0	433.8
1975	538.0	542.6	***2006***	367.2	464.4
1976	575.8	561.2	***2007***	369.2	453.8
1977	532.7	447.1	***2008***	355.8	425.4
1978	574.3	820.0	***2009***	377.8	457.5
1979	533.9	777.9	***2010***	320.3	379.7
1980	627.6	701.3	***2011***	367.2	613.3
1981	623.0	552.6	***2012***	332.7	578.4
1982	653.8	853.9	***2013***	332.5	497.5
1983	655.8	923.5	***2014***	312.9	391.9
1984	645.9	982.8	***2015***	294.2	535.7
1985	560.6	881.1	***2016***	307.7	484.8

Fishing effort and landings in the Atlantic Menhaden purse-seine fishery, 1955-2016					
Year	**Fishing effort vessel-weeks**	**Landings 1,000 metric tons**	**Year**	**Fishing effort vessel-weeks**	**Landings 1,000 metric tons**
1955	2748	641.4	***1986***	377	238.0
1956	2878	712.1	***1987***	531	327.0
1957	2775	602.8	***1988***	604	309.3
1958	2343	510.0	***1989***	725	322.0
1959	2847	659.1	***1990***	826	401.2
1960	2097	529.8	***1991***	926	381.4
1961	2371	575.9	***1992***	794	297.6
1962	2351	537.7	***1993***	626	320.6
1963	2331	346.9	***1994***	573	260.0
1964	1807	269.2	***1995***	600	339.9
1965	1805	273.4	***1996***	528	292.9
1966	1386	219.6	***1997***	616	259.1
1967	1316	193.5	***1998***	437	245.9
1968	1209	234.8	***1999***	382	171.2
1969	995	161.6	***2000***	311	167.2
1970	906	259.4	***2001***	334	233.7
1971	897	250.3	***2002***	318	174.0
1972	973	365.9	***2003***	302	166.1
1973	1099	346.9	***2004***	345	183.4
1974	1145	292.2	***2005***	291	146.9
1975	1218	250.2	***2006***	322	157.4
1976	1163	340.5	***2007***	333	174.5
1977	1239	341.1	***2008***	262	141.1
1978	1210	344.1	***2009***	300	143.8
1979	1198	375.7	***2010***	356	183.1
1980	1158	401.5	***2011***	324	174.0
1981	1133	381.3	***2012***	279	160.6
1982	948	382.4	***2013***	196	131.0
1983	995	418.6	***2014***	201	131.1
1984	892	326.3	***2015***	182	143.5
1985	577	306.7	***2016***	213	137.4